

Running head: IMPROVING FIRE APPARATUS OPERATORS

EXECUTIVE DEVELOPMENT

Who Is Driving Our Fire Apparatus?

Improving Skill Sets For Fire Apparatus Operators.

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the Executive Fire Officer Program

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed:_____

ABSTRACT

The problem examined is a deficiency in experience levels of fire apparatus operators within the York Center Fire Protection District. This deficiency puts both the public and firefighters at risk of injury or death and increases the potential for litigation against the York Center Fire Protection District. The researcher evaluated several apparatus accidents where firefighter fatalities occurred and the general causes have been attributed to the following: 1. Personnel not following established policies and procedures and 2. Driver errors. In reviewing the driver error causes, several similarities became apparent: 1. Driver age; 2. Driver experience levels; and 3. Driver training levels.

The purpose of this research project was to describe how current fire apparatus operators are being trained. Descriptive research methodology was used to answer the following questions:

1. What are the experience/training levels of fire apparatus operators involved in apparatus accidents where firefighter injuries or deaths have occurred?
2. What are the experience/training levels of fire apparatus operators in incidents where firefighters were injured or killed due to pump operator error?
3. What experience-building programs are currently being used by fire departments for the training of fire apparatus operators?

4. What are the positive and negatives of available computer-based simulations for the training of FAOs?
5. What are the long-term effects on a fire department personnel when personnel when a loss of personnel occurs in a FAO incident?

The procedure employed to complete this research began with a review of the literature. Then the researcher conducted personal interviews with informed representatives who develop computer simulators used for driving and pump operations, end users of the simulators, two large fleet driving trainers (UPS and FED-EX), and two fire chiefs who were involved in a line of duty death that occurred as part of a fire apparatus accident.

The result of this research indicated that frequent and structured driver and pump operator training is required to maintain effective fire apparatus operators. The development of evaluation criteria must be developed for use to evaluate driver/operators. A safe driving committee should be established consisting of personnel who drive the apparatus; i.e., the committee would evaluate policies, mentor new drivers, and evaluate current drivers. Lastly, it was found that while most computer-based simulators provide very successful training, the units are not cost effective for small to mid-sized departments. The research explored alternative funding possibilities for the purchase of the simulators, but other issues regarding the use of the simulators became prevalent.

The research revealed recommendations for the current York Center Fire Protection District Driver Training Program. The recommendations included an increase in training hours, how drivers are evaluated and how new drivers are trained.

The researcher recommends two areas of future research to be conducted:

1. Qualifications of instructors who conduct driver's training as well as minimum required qualifications.
2. A citizens, education program should be researched to train citizens on how to deal with an approaching emergency vehicle.

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INTRODUCTION

In the American Fire Service over 100 firefighters are killed every year. Some of these deaths by nature are unpreventable. Firefighter fatality investigations have shown that twenty-five percent of preventable firefighter deaths occur during response to or returning from emergencies. Fire apparatus operators (FAO) are being criminally charged when a serious injury or death occurs from an accident involving a fire apparatus. Additionally, organizations who fail to recognize that the FAO requires special, recurring and documented training is unacceptable and facilitates litigation.

The problem the York Center Fire Protection District (YCFPD) has encountered is a lack of experience both in driving and fire pump operations, as well as how to provide effective training that can increase the experience levels of the FAO. The YCFPD is a combination fire department that employs off-duty and part-time firefighters for neighboring communities. Understanding the importance of a solid foundation for the FAO, the need to analyze the current driver's training program became evident. In recent years, the YCFPD has had two close-call situations that resulted in damaged apparatus and, in a neighboring community, a documented firefighter fatality was caused by an FAO error.

Currently, the YCFPD does have an FAO policy which has gone through several revisions.

There are several short-comings in the current policy: who trains the new drivers, how much driver training is required, and how the training is completed. One major obstacle in the policy is because YCFPD employs personnel from full-time fire departments who bring with them “training and experience”; there is no criterion to evaluate their experience and training.

The purpose of this applied research is to determine what modifications to the current FAO training policy should be made to make the program more effective for both the new and established FAO and to increase the safety for all personnel. Descriptive research will be utilized to answer the following questions:

1. What were the experience/training levels of the FAO involved in vehicle accidents where firefighter injuries or fatalities have occurred?
2. What were the experience/training levels of the FAO involved in vehicle accidents where firefighter injuries or fatalities have occurred due to pump operator errors?
3. What experience-building programs are currently being used by the fire departments for FAO training?
4. How are fire departments maintaining the skill levels of the FAO?
5. What computer-based simulations are available for the training of the FAO? Additionally, what are the positive and negative aspects of these training simulations?

6. What are the long term effects on fire department personnel when a fatality occurs in a FAO error incident?

BACKGROUND AND SIGNIFICANCE

The YCFPD is not an incorporated municipality like most departments across the country, but is a fire protection district located 20 miles west of the City of Chicago. The York Center name comes from being at the center of York Township which is part of DuPage County, Illinois. The municipalities that YCFPD provides services for has seen substantial growth in the last 10 years due in part to the district's close proximity and easy access to the City of Chicago. The municipalities have grown from bedroom communities to high-rise corporate headquarters and large multi-family residential buildings. The day-time population and traffic patterns through the area have also seen a tremendous increase. Lastly, with general costs and transportation times to get into Chicago, businesses are looking at alternative locations and the suburban communities provide that alternative.

The YCFPD became an organized fire protection district in 1958. The communities that surrounded the fire protection district did not have enough staffing or funding to provide service for the unincorporated areas of the district. The unincorporated areas of Lombard, Villa Park, Oak Brook and Oakbrook Terrace were without services, leading to the development of YCFPD. The original organization was the typical volunteer fire department with a first responder ambulance service. As demand for services increased and the complexity of patient care increased, YCFPD saw the need to institute paramedic service and to make those services available 24 hours a day.

In the late 70's, paramedics were hired to staff the station; however, fire department operations were still carried out by personnel called back to the station. As growth continued, it was determined that a fully staffed fire department was needed but because of budget constraints hiring full-time firefighters was not an option. It was determined the need for services could be met with a part-time staff supplemented with the staffing called back. This arrangement worked until training and call back personnel began to move out of the area. A change was made again to move from the call back personnel to a fully staffed fire department using part-time personnel. The current staffing status of YCFPD is 70 total personnel that staff the fire station with seven personnel 24 hours a day 365 days a year. This has been a very fast transition for senior members of YCFPD and has also been the source of the development of this applied research paper.

The YCFPD always had its concerns regarding FAO trained in –house, but now because of the employment of personnel from other entities the concern has multiplied. The YCFPD has experienced two close-call incidents that have resulted in injuries and equipment damage. One incident that deeply affected the members of YCFPD deeply occurred in a surrounding community when two fire apparatus collided resulting in the ejection and death of a firefighter. The YCFPD sent personnel to the funeral and had the chief of one of the involved departments to conduct a training session during the 2006 Stand Down observation to provide an understanding of the importance of

driver's training, the importance of safe driving, and how unsafe drivers caused a fatality in his department and the lasting affects of the department's personnel.

The current YCFPD administration fully understands the dangers in fire apparatus operation and has taken strong, proactive measures to reduce the potential of injury/loss of personnel and damage to equipment. The YCFPD developed its first FAO training policy in the late eighties. Until that point, it was considered the first personnel to the station off probation drove. Significant changes have been made since that time. With the use of the National Fire Protection Association (NFPA) 1002 *Standard for Fire Apparatus Driver/Operator Professional Qualifications* and NFPA 1451 *Standard for Fire Service Vehicle Operators Training Program*, a solid training foundation has been developed. The FAO policy has been changed and revised since its adoption, but the core of the policy has not been changed. An additional step that has been taken recently is a partnership between the Illinois Department of Transportation and YCFPD, allowing third party certification of firefighting personnel to get an appropriate license to operate fire apparatus. Personnel are still required to take their initial test at a facility, but the actual driver's training takes place at YCFPD. Re-evaluation of policies and recommendations of how to improve FAO training is another illustration of the safety-orientated philosophy and the must have attitude to prevent injury and harm to YCFPD personnel.

It is imperative that fire departments have FAO training policies in place.

Goldfeeder (2006) stated the following regarding FAO training:

Naturally, the issues of **WHO IS DRIVING** your fire apparatus is worth thinking about. Who are they at your FD? What are their qualifications? How were are they trained? How experienced are they at driving...anything? Are they sober? Do they know where the brake pedal is? Are they excitable? Do they spend more time watching NASCAR than attending training? Stuff worth thinking about.

Three major incidents led to the need to effectively research training of the FAO. Two of the incidents directly affected YCFPD and the last affected the fire service in its entirety. The first event was a result on a lack of training. While the FAO had completed the YCFPD training program, there were two areas that lacked attention. The event was the cavitation of a fire pump during a live fire training situation. The FAO did not circulate water through the fire pump and because water was not flowing, the result was pump damage to a new fire engine. It was determined that the FAO had completed the YCFPD FAO course, however the time spent doing actual fire pump operations was never determined. Another problematic situation that arose from this event was the qualifications of the instructor who taught the FAO to operate the fire pump. While documentation of time spent in training has been reviewed and updated, instructor qualifications are still an on-going dilemma.

The second incident involved an accident between an ambulance and a civilian vehicle. While no moving violations were issued to any party, the ambulance in question was heavily damaged and the incident sent two YCFPD personnel and two civilians to the hospital. The event happened on a highly traveled road and brought a very sobering experience and a realization of what can happen to our personnel. Several questions arose regarding initial training and on-going training with the specific vehicle. Unfortunately, the need to provide supplemental training for personnel involved in prior accidents was not addressed. The driver of the ambulance had been involved in prior minor accidents and the potential problem could have been foreseen, addressed, and hopefully avoiding any further situations.

The last event had far-reaching affect into the fire service. In a neighboring community two fire apparatus collided in an intersection when responding to a garage fire in a third community. The two vehicles responding were summoned for mutual aid assistance to the scene of the fire. The result of the collision ejected the driver from the fire apparatus onto the roadway and was the fatality in the accident. The National Institute of Safety and Health (NIOSH) investigated the accident and report F2004-43 stated the following:

- The department must provide training to driver/operators as often as necessary to meet the requirements of NFPA 1451, 1500, and 1002. This training should incorporate specifics on intersection practices.

- The department must develop and enforce standard operating procedures (SOPs) for seat belt usage, intersection practices, and responses to mutual/automatic aid incidents.

The incident had far-reaching implications resulting in the writing of this paper. Emotions still run high as a result of this incident and hard feelings between the departments are readily apparent. To this day YCFPD members who attended the funeral for the lost personnel are still affected to and hold FAO training essential to the training of personnel.

This research project will assist in resolving the problem of FAO training by allowing YCFPD administrators to make informed decisions when considering training revisions and assignment of personnel as FAOs. This examination of current and state-of-the-art the training programs will directly impact the safety of personnel by making recommendations that will incorporate into YCFPD a personnel safety standard, training and operations at emergency incidents. The intent of this research is to enhance the ability of firefighters to survive deadly situations and will support one of the major fire operational objectives of the U.S. Fire Administration (USFA) (2003), to “reduce the loss of life from fire of firefighters” (p.-II-2). While the stated objective surrounds safety in operating at the fire scene, the increasing number of firefighter fatalities due to responding to and returning from incidents, firefighters cannot operate at incidents if they do not arrive the scene safely.

In addition, this applied research will be used to meet two goals for students of the National Fire Academy's (NFA) *Executive Development* Course. The first goal is that Executive Fire Officers (EFO's) be able to provide leadership to their department by applying the results of their research (NFA, 2004). The second goal is for the EFO's "to use research to solve real-world problems in their work environments" (NFA, 2004, p.SM12-4).

LITERATURE REVIEW

Every person involved with the fire service is well aware of the increase in fire fighter fatalities. Also widely known is the preventable number of deaths and injuries caused in vehicular accidents. The U.S. Fire Administration (2007) research concluded 25% of firefighter deaths are caused while responding to, or returning from an alarm. The types of accidents are always the same: roll-overs, ejections and intersection collisions. Accidents will happen and in today's atmosphere of litigation, every fire department would be well-advised to take steps to increase the safety of their FAO's in the operation of vehicles. Daly (2006) continues to state "due to the circumstances that accompany traveling in emergency response mode, the drivers are subject to a much greater potential or liability exposure than that experienced by regular commercial truck drivers"(p.61). "The commercial truck driving community considers driver training as one of the most important factors to a successful career" (Smith, 2006, p.102). According to reports from the Fatality Analysis Reporting System (FARS) and the Motor Carrier Management Information System (MCMIS), crashes involving large trucks are increasing. The Federal Highway Administration and Highway and Traffic Safety Administration identified fatality crashes between cars and commercial trucks are the fault of the other driver, 71% of the time. Daly (2006) relates that in "today's fire service many apparatus operators are amateur truck drivers operating large, heavy vehicles under emergency conditions"(p.59).

Identifying that the large majority of accidents is the fault of someone else other than the fire apparatus operator; makes the apparatus operator's training even more critical. Driving fire apparatus is a complex activity involving skills acquisition at varying rates and levels of control. The ability to safely control and maneuver fire apparatus is a critical part of the FAO's responsibilities. Dealy (2005) recommends an eight point system to developing a safe driving program. Most of Dealy's points support NFPA 1002 Fire Apparatus Driver / Operator Professional Qualifications (2003) and NFPA 1451 Fire Service Vehicle Operations Training Program with points 6 and 8 deserving special consideration. Dealy's Point 6 develops the concept to establish a safe driving committee for an organization and would be developed with the following guidelines:

1. To manage the department's safe driving program.
2. To monitor driver training and suggest improvements.
3. To seek ways to make current driving Standard Operating Procedures (SOPs) safer.
4. To review accidents to improve future driving practices.
5. To consider any complains against drivers.

Dealy's Point 8 which also deserves consideration recommends establishing a safety award program that annually recognizes accident-free drivers with some token of appreciation.

In the modern fire service where staffing is at a premium and all personnel are asked to perform FAO duties, the selection of personnel to award may become difficult, or may cause a morale problem in the department. Dealy (2005, p.106) concludes his article with a suggestion to contact insurance carriers for training materials, i.e. their Loss Prevention Department may have an extensive library that can be used for increased FAO training.

Firefighters undertaking training want to improve their skill sets. Bixby (2007, p.2) defines “skill sets as training, which the student can draw on to perform in pressure situations”. In the area of FAO, skills sets can be clearly divided into fire apparatus driving and fire apparatus operations. Fire apparatus operations can be defined as the ability to use the vehicle once at the scene of an incident.

Today’s fire apparatus are outfitted with numerous state-of-the-art safety devices such as anti-lock brakes, load managers and LED lighting which increases firefighter and civilian safety. However, driver error is the one commonality in fire apparatus accidents. The NFPA has developed standards and the Insurance Service Organization (ISO) “recommends a minimum of 40 hours of driver training and eight hours of pump training” (Hickey, 1993 p.159-160). Mercieri (2007) reviews “a multi-level plan for driver training of both new and existing FAOs, that exceeds ISO and the NFPA standards” (p.3). Mercieri (2007) recommends:

A foundation training for all drivers to complete an NFPA accredited driving class. Also as part of the foundation development, the driver should be sent to a State Fire Academy or State College for an accredited driving class. Once the foundation is set, the candidate driver should move on to the second phase which should insure a thorough understanding of all department protocols and SOPs. This phase should also include the candidate becoming familiar with vehicle control systems, safety systems, emergency overrides and other critical equipment. Mercieri's (2007, p. 5-6) final phase recommends "the candidate drive any apparatus they may have the opportunity to drive. The initial training should be in non-emergency conditions and during this segment the candidate should experience all types of roads found within the jurisdiction." A noteworthy area Mercieri recommends that once the candidate has demonstrated competencies driving during day, additional night driving training be initiated. The vehicle's cab and the views from the cab are very different at night. Because new driver and established driver proficiencies can be a question, Mercieri offers a mechanism to ensure FAO proficiency. The recommendation is to have drivers perform a minimum of 2 hours of training per month with an additional defensive driver's obstacle course as outlined by the Volunteer Firefighter's Insurance Service (VFIS). An additional recommendation is to perform a minimum of 2 night training sessions and one night obstacle course.

Mercieri concludes by offering skills that are not practiced daily or weekly can cause critical skills to be forgotten and that refresher training on pump and aerial ladder operations can also be beneficial.

Another proposed means to increase the skill set of FAOs is virtual reality training. Virtual reality began as a training tool for pilots and flight simulators are still among the most popular virtual training programs. The concept behind virtual reality training for pilots is to reduce the amount of time a pilot must spend in the air during training; in doing so the expense and risk are also diminished. The idea of simulation programs can also reduce risk to machines, the environment, and human lives as suggested by Luneeford Jr. (2000 p.20). Luneeford Jr. (2000) also states “the simulations computers that run programs can be set up to keep records of the students’ actions, giving teachers, students, and researchers the opportunity for review that live training cannot offer” (p.5). Luneeford Jr. (2000) does warn “that simulators should never replace actual flight in the case of flight simulators because simulators cannot show all possibilities that can happen to a plane in bad weather. Simulation does not replace actual vehicle training, but rather enhances it” (p. 3-4). Actual vehicle training develops a student’s precision-driving skills while simulation training develops decision-making skills. The Los Angeles Fire Department, California (LAFD) and the Fire Department of New York Emergency Medical Service (FDNY EMS) uses a driving simulator for new and existing drivers.

The LAFD and FDNYEMS both use one of the major manufacturers of driving simulators; i.e., FAAC, Inc, of Ann Arbor MI. Espinosa (2005) offered driving simulators have been used by law enforcement trainers for some time, but are relatively new to the fire service and that LAFD was like most fire departments in that the bulk of drivers' training came on the job with LAFD assigned instructors being the rated members at the fire station level. In an LAFD study of 824 crashes involving LAFD vehicles and civilian vehicles, 143 crashes of the total crashes resulted in injury to either LAFD personnel or civilians (including three fatalities). The City's Attorney's Office recorded approximately \$ 4.6 million was paid out to plaintiffs resulting in litigation following these crashes. The FAAC, Inc., system is the EV-1000/V3 system. The system is composed of simulators and essential software that will create an interactive simulated environment with traffic pattern challenges, pedestrian/civilian vehicles responding/not responding to emergencies with lights and sirens, real time hazards (car doors opening into traffic) fire and smoke visuals, day and night levels and weather variations. Espinosa (2005, p.3) states the "simulators were designed to augment the LAFD's existing driver's training program, which did not include an emergency driving component". Espinosa (2005) did offer that "simulator does offer additional characteristics other than basic driver training; those are accident analysis, reconstruction, and remedial training" (p.2).

These components offer the training that is critical to the development of FAO skill sets. Espinosa (2005) concludes his thoughts with “the cost of the simulators being a substantial investment of \$500,000, but the value of continuing to improve LAFD members’ driving skills obviously goes beyond limiting monetary cost such as the \$4.6 million in City litigation settlements”(p.5)

FDNYEMS uses their simulators in the same basic concepts as LAFD, but with some differences in the training programs. FDNYEMS driving procedures surround ambulances only whereas LAFD’s simulators use engines, tiller trucks, ambulances, and staff vehicles. LAFD personnel are required attend quarterly training sessions in the simulators as compared to FDNYEMS employees who spend 15 minutes per shift in the simulators. The results of simulator training cannot go without notice because FDNYEMS has shown a 12% reduction in overall collisions with a significant reduction of 38% in intersection collisions. The LAFD has experienced a 43% reduction in accidents. Beyond the initial cost, simulators do not go without problems in their use.

Fried (2003) offered that “simulators should be used in conjunction with “hand-on” driving, not as a stand alone method” (p.3-4). As stated above, Fried confirms that funding for simulators is difficult to acquire. In a study conducted by Hubal and Mills (2003) several additional short-comings were noted with simulator-based training.

Some of the concerns noted by Hubal and Mills(2003) could be largely identified at plateau learning. “When the students were asked to use the simulators numerous times within a short time windows, the students quickly became good at scoring well and then became bored with the simulation and also produced data that showed scores increased markedly by the first to the second simulations, the scores showed some increase from the second to the third simulation and by the fifth simulation the scores were essentially perfect” (Hubal and Mills, 2003 p.8-9). Hubal and Mills (2003) data concludes by finding that simulators are useful for gaining some basic driving kills or assessing some personal abilities on an initial or periodic basis. Simulators have their limits (e.g., in realistic environments and capabilities) which rapidly become distractions to students when they are used often over short time periods.

Part of being a successful FAO also requires the ability to operate effectively and safely a fire pump. NFPA *Fire Apparatus Driver/Operator Professional Qualifications 1002* (2003) Chapter Five, discusses the FAO having the ability/training to:

Produce effective hand or master streams, operate from a static water source, operate pumper pressure control systems, operate pressure/volume transfer valve (multi-stage pumps only), make transitions between internal and external water sources, and assemble hose lines, nozzles, valves and appliances.

Similar to new FAOs gaining effective skill sets when driving, the same problematic situation holds true for new pump operators. Most fire departments train their pump operators through a State Fire Marshal or college level course. From survey results, most programs are between 16 and 40 hours in duration. Generally, the essential objectives of the course have students flowing water through fire nozzles with no hose attached to the fire pump. A new concept in pump training was found from FD Training Systems. Bixby (2007) evaluated the simulator and found it to have better results than most computer-based simulations. A very unique feature is the evaluated simulator allows the student to have hands on the student's own fire pump. The simulator allows the student to connect fire hose to the simulator and then use their own pump in a closed loop system where the pumped water then becomes the pump's supply. Per Bixby (2007), the computer based scenarios can be tailored to the equipment and needs of the individual department. Bixby (2007) found the ability of the pump operators to evaluate computer-generated problems and take corrective actions was essential to development of strong skills sets for FAOs. He also found that several scenarios provided skill sets, i.e. a broken hand line, lines that are deployed and shut down, that an FAO may never see in their career, however can be threatening to firefighter safety if not handled correctly. The Mills and Hubal (2003) study described "that the students in order to build effective skills sets, must use the equipment they will use in their operation.

Without the use of their equipment, the skill sets will not be learned moreover cannot be applied” (p.10-11). Mills and Hubal (2003) stated “that once skills sets are learned and the student is familiar the skills can be applied in most situations, however skill sets that are learned on a different piece of equipment and then attempted to be applied is generally unsuccessful” (p.14-15).

Interviews conducted by Bixby (2007) found that the students appreciated the ability to read actual pump panel and gauges, hear the engine of the vehicle and the pump of the vehicle. Students are able to develop several skill sets from trouble-shooting the pump, the engine and also react to radio traffic from the incident. As with any simulator Bixby (2007) found limitations with the simulator the first of which is limitation that the unit could not simulate working from a pressurized water source. As with any simulator Bixby (2007) also found cost to be a substantial factor to over- come. The FD Training System can be bought at a cost of \$80,000, leased for a number of days or weeks or rented which includes an instructor all at varying rates depending on time of use.

Experience and maturity as an individual is a critical component to FAO success. The safe operation of any vehicle is determined by the attentiveness, alertness, and training/ability of an individual to apply their training to the task of driving and operating fire apparatus safely.

Whether personnel drive cars, sports utility vehicles (SUV), long haul trucks or fire apparatus it is vital for personnel to bring along one item....safety awareness stated by Rothstein (2006). In the Illinois Office of the State Fire Marshal's (OFSM), Fire Service Vehicle Operator curriculum describes several obstacles that can reduce personal safety awareness in driving. The obstacles can be separated into three areas: driver judgment, skills and abilities. To this point research has reviewed opinions of how to increase and evaluate the skills and abilities of the FAO. Conducting reviews of NIOSH firefighter fatality reports of vehicle accidents two circumstances become evident: driver judgment and training. It became clear that driver judgment causes two defining factors began to surface: age of the FAO and time on the job of the FAO. Most of the vehicle accident reviewed showed an FAO of between 18-22 years of ages with between one and three years of experience. Daly (2006) cites that "firefighters have a "can do attitude", which gets applied to cannot do situations" (p.6). Those cannot do situations are to assign inexperienced personnel to the FAO positions. The OFSM Fire Service Vehicle Operators curriculum identifies several concerns with the age of the FAO; most notably physical and mental conditioning that is reflected in chronological age. A second concern is does the young FAO have the ability to make sound judgment decisions. With limited time of the job, young/inexperienced FAO have limited skill sets which OFSM found to increase excitability, lack of maturity when driving the apparatus, poor driving

habits that are exercised in the FAO's personal vehicle and are demonstrated in driving the fire apparatus, and lastly a lack of safe driving characteristics; i.e., manipulative skills necessary to coordinate steering, accelerating, and braking functioning of an emergency vehicle. This creates a group of FAOs that do not know the limitations of driving a large vehicle. Daly (2006) sums this ideal up by having the opinion that if FAOs are not trained they do not have the skills sets to understand how physical forces effect/influence how an emergency apparatus will behave on the road. These conditions require drivers with plenty of training and experience, not rookies. Cavette (2007) found that drivers should be given training that includes classroom training, behind-the-wheel training, but most important is the guidance of more experienced personnel before new FAOs are allowed to respond to emergencies.

The United States Fire Administration (USFA) has identified the operation of an emergency vehicle as one of the most common functions performed by today's fire service personnel; however, it is also one of the most dangerous. The effects of the loss and/or injury of fire service personnel can cause long-term detrimental problems for a fire department. The USFA Emergency Vehicle Driver Training Program identifies the loss from vehicle accidents on three levels: personnel injury/death, civilian injury/death and equipment loss. The risk of personnel injury or death can affect the organization by losing key personnel forever. Sweeney (1999) found that for the families and co-workers

lives after the loss never returned status-quo. For the departments in our area who were involved in a two fire apparatus collision, both departments are still effected from an accident that occurred in 2004. He also found that a line of duty death effects a department to its core and preventable death begins to question the leadership of the department. When the core and leadership are questioned, this can cause long-term detrimental effects on the department and manifests itself in morale issues, personal issues, i.e., alcohol and/or drug abuse and department effectiveness. The International Association of Fire Chiefs' Foundation (IAFCF, 1991) has stated that "Stress is one of the most serious occupational hazards in the fire service, affecting health, job performance, career decision-making, morale and family life. Emotional problems, as well as problems with alcohol and drugs are becoming increasingly evident." In the case of NIOSH Report #200443, where another fire department is involved in the accident, questions between departments begin to arise and cohesion of the departments to work together is questioned. If an inexperienced and/or poorly trained FAO causes an injury or death of personnel or a civilian, there is a definite long-range impact on the families of all affected individual(s). If the victim is injured and unable to work, most insurance does not afford the ability to provide for the family of the victim. The UFSA recommends to consider the cost of living and raising a family and how long the death benefit of \$ 50,000 would last the average family?

Clarke and Zak (1999) summarize “that traumatic events such as a preventable line of duty death have a profound and sometimes insurmountable impact on the mental and physical health of the firefighters and the department” (p.15).

PROCEDURES

This research project utilized descriptive research methodologies. The procedures employed to complete this research included literature reviews, evaluations of training/experience levels of FAOs involved in vehicle accidents and pump operator errors, personal interviews and surveys of FAO training program requirements across the region.

The literature review was initiated at the National Emergency Training Center's Learning Resource Center in March of 2008. Further literature searches were conducted at the public library in West Chicago, Illinois. Finally, additional information was gathered from both the author's private library and from the York Center Fire Protection District's library. NIOSH reports, journals, magazines, NFPA documents and training documents from the Southern United Training Academy, Darien, Illinois and the Illinois Office of the State Fire Marshal were examined during the research process. Relevant sources were included in the Literature Review portion of this paper.

NIOSH reports on firefighter fatalities were reviewed. The reports were limited to firefighter fatalities that occurred in apparatus accidents. No personal vehicle (POV) firefighter fatalities were reviewed. The years of review for firefighter fatalities were limited to a ten year period from 1997-2007. Since no valid data was found for firefighter fatalities attributed to pump operator error, a new source was used.

The Firefighter Close-Call Reporting System was used for data regarding firefighter injury or potential for firefighter injury was used as a source. Several documented cases were found and evaluated to define results of pump operator errors.

The last procedure was to conduct a survey of the fire service Training Officers to get an accurate account of what types of FAO training was being conducted, how often, who was doing the training and how many years of service personnel had that were receiving the training. The survey was built using SurveyMonkey.com and was sent out through the National Fire Academy (NFA) Trade network. The questions posed were:

1. How is your fire department staffed?
2. How does your fire department/district select Fire Apparatus Operators (FAO)?
3. How much time must personnel have on the job to operate as an FAO?
4. Does your fire department/district have a formalized FAO training program?
5. How do FAOs for your department/district receive initial training?
6. Who currently trains your department/district FAOs?
7. How often are your department/district FAO's core competencies (driving and pump) evaluated?
8. How are your department/district FAO's core competencies evaluated?

9. Describe any successful driver's training/pump operator training that has decreased "Close Calls" for personnel of your department/district.

Personal interviews were conducted as a means of determining of the practicality of virtual reality driver's training programs and pump operator training programs. The interviews were conducted on two different levels: 1. the manufacturers of the driving systems and 2. the pump operator training systems. These interviews were conducted at the 2008 Fire Department Instructors Conference (FDIC) held in Indianapolis, Indiana. The manufacturers were asked the following questions:

1. What is the name of the company, location of the company, how many units have been sold and to whom?
2. Identify the components of the training program and what equipment is necessary to make the equipment as effected as possible.
3. How are the instructors of the purchaser trained?
4. What are the positive and negative characteristics of the training simulators?
5. What would the cost of a simulator that would be effective for York Center Fire Protection District?
6. What feedback back has been received back regarding service, break-downs, and over-all use of the simulators?

After the manufacturers of the simulators were interviewed the purchasers' of the simulators were posed the same questions via e-mail. The researcher felt the best way to get a true representation of the effectiveness of simulated

training was to get information from the manufacturer and the end-user.

Because no end-user with a make up close to that of YCFPD could be found, results were taken from the end-user with the most students going through the training using the simulator.

Lastly, interviews for feedback to the final research question were asked of two Chief Officers who were intimately involved in the fire apparatus accident that occurred in the western suburbs of Chicago. The Chief of the Stone Park Department Jim Cummins, Stone Park, Illinois and the Deputy Chief of the Northlake Fire Department Paul Feldman, Northlake, Illinois were interviewed to get their perspective on the accident and FAO training.

Both chiefs were posed the following questions:

1. What were your initial impressions when you heard your apparatus was involved in an accident and further what were your reactions when you found out it was with another fire apparatus?
2. What coping mechanisms did your personnel use to cope with the incident?
3. What were your training requirements prior to the accident for the training of FAOs?
4. How has your department increased FAO training since the accident?
5. What is the feeling in your department since the accident with the members and toward the other department?

This author assumed that each interviewee was accurate in answering the interview questions.

Definitions:

Fire Apparatus Operator (FAO). Personnel that are assigned to drive and operate any type of fire apparatus under emergency conditions or at the scene of an emergency.

Fire Department Instructors' Conference (FDIC). A yearly conference hosted in Indianapolis, Indiana. The conference host state-of-the-art training seminars and a large exhibit of cutting edge fire service equipment.

Fire Fighter Close Call Reporting. A national resource that allows fire fighting personnel to learn from incidents where a firefighter came close to being injured or potentially killed.

Personally Owned Vehicle (POV). A vehicle owned by the firefighter; not fire service related or fire department owned.

RESULTS

Research Question 1. In a fire apparatus accident where operator errors have been determined to be the cause the experience levels of the operator have been between 1-5 years of FAO experience; averaging 3 years of experience. The data from the survey reinforced these ages by showing that 73% of the departments surveyed, FAOs were trained with 1-5 years of on-the-job experience. In more alarming data, 20% of the departments surveyed were training FAO's with less than 1 year of job experience. An additional area of interest was how the FAOs were selected to operate the apparatus; 39% of the departments had the FAO rank tested/promoted with 41% at the officer's discretion and followed by only 19% decided by time on the job.

Research Question 2. The lack experience/training levels for the fire pump operator is more alarming than driver operator training, due in part to the number of structure fires being down nation-wide. In day-to-day operations there is the opportunity to drive fire apparatus both in emergency modes; i.e., emergency medical calls, activated fire alarms and in non-emergency modes such as company inspections or department errands. With the number of structure fires being down the opportunity to use the fire pump in a critical mode is significantly reduced, making the need for realistic training more essential. The departments surveyed were encouraging because 76% had a formalized FAO training program of most concern is that only an alarming 26% of the departments had no formalized training programs for FAO's.

No training programs combined with the diminishing opportunities to use the fire pump in critical/pressure situations equates to the excess number of “close-call” situations firefighters.

Question 3. Several different means are being used by fire departments to build the experience of the FAO. Fifty percent of the departments are using an on-the-job training program that incorporates both a driving module and pump operator module. The problem found with this approach is that the training time is generally scheduled or time has to be made in the day to accommodate this training. The essential aspect that is missing is the “emergency” portion to which makes the training realistic. Thirty percent of the departments surveyed are using a formalized “in-house” training program to train FAOs. Two areas of concern were identified using this approach:

1. Consistency in the instruction.
2. Time to put the FAO through the training sessions.

Twelve percent of the departments surveyed sent the FAO out of the department to a training session provided by a State Fire Marshal or a university training program. The number one concern with this type of training is cost. Cost for overtime to fill the vacancy made by the trainee leaving the department and cost for the class. The problematic area of skill maintenance begins to develop in two separate areas. The first area of concern would be who trains/evaluates the core competencies of the FAO.

In the departments surveyed, 62% of the evaluators are the department Training Officers, 20% use current FAO, 11% use the company officer and 7% never have their core competencies evaluated. A second area of concern is how often the FAO's skills are evaluated. Fifty percent of the departments surveyed evaluate once a year, 10% are evaluated bi-annually, 14% are never evaluated and 25% are evaluated only after a problem is noted.

Question 4. The interviewed manufacturers of the driving simulations were from Capital I-Sim, Salt Lake City, Utah and FAAC, Inc, Ann Arbor, Michigan. Representatives of both companies offered a tremendous amount of information beyond answering the cited questions from above. It was concluded that both systems required a significant commitment by the purchaser to provide the required computer system, identified permanent space for the simulator, and personnel to be trained as instructors. Additionally, the purchasers will need a cutting-edge information technology representative in order to repair and trouble-shoot any system malfunctions. Both systems simulated different weather, time of day and road conditions and provide a multi-view driving perspective; i.e., front, rear and sides through the use of plasma screens. The simulators also both offer realistic features of actual driving; i.e., bumps in the road, noise of vehicle acceleration and braking noises. The FAAC, Inc., also offers one feature that is a tremendous asset to instructor and student which is a "play back" feature.

The play back feature offers instructors and students the ability to look at the scenario, review positives and negatives of the driver's actions and lastly, show the new student what has happened in past scenarios. The FAAC, Inc., product also offers views from several different types of vehicles: ambulances, fire engines and cars. The Capital I-Sim offered only the view from a truck. Both organizations insist the training of on-site instructors is essential to the success of the simulators. The firms both provide company instruction to train the purchaser's instructors. The FAAC, Inc., units have been sold to fire service organization where actual data and feedback can be reviewed. Two organizations surveyed were FDNYEMS and LAFD. The most significant data received from both organizations is a reduction in vehicle accidents. Both organizations agreed with the FAAC, Inc., representative that the system does require a significant commitment by the organization to make the simulators effective in training. The FDNYEMSS personnel are required to document 15 minutes per shift in the trainer. The LAFD personnel are required to train eight hours in the simulators quarterly. Also, LAFD has taken the use of the simulators to a further extent by purchasing a separate building to house the simulators. The building is separated into areas for engines, trucks, tiller operators, and ambulances. Both organizations offered that downtime due to problems with the software was a minimum; however, that because of the demand on the computer system it was essential to get high demand, proficient hardware that is

dedicated only to the simulators. In a discussion regarding the student and feedback from the effectiveness of the simulators, both organizations offered that some evaluation time was needed in order to develop a rotation for training. Initially, both organizations brought students in for training so often that the students began to perfect the simulator and were leaving with no effective training. Once the rotation was developed, students were questioned on how the training could be more effective and this was how the rotation was developed. Significant concerns for both organizations were the initial costs of set-up, cost to maintain the simulators, overtime pay for the students to train and the instructors to train the students. The surveyed organizations have initiated several methods to off-set the financial cost of simulators in different ways. FDNYEMS, uses an “instructor-less” system where the students have to document 15 minutes per shift in the simulator. The student gets a print-out of the results and those results are handed to the training division for evaluation. If the results are rated anything less than average, the student is brought in for remedial training with an instructor. All training is documented and entered into the personnel file of the employee. The LAFD has a full-time training staff at their site, but the costs are off-set by renting the facility to other California fire departments to use their staff training. This has proved to be one effective mechanism to off-set instructor costs.

The only manufacturer of a hands-on practical pump trainer is FD Training Systems, Inc, DeCordova, Texas.

The research found several computer-based pump operator training systems, but having experienced a virtual pump training session, the researcher felt these system did not improve the skill sets of pump operator. It is felt by the researcher that to improve the skill sets of the pump operator several requirements need to be met:

1. The actual apparatus the operator will be using needs to be trained used.
2. Water needs to be flowed so the operator can see the actual gauges that will be seen on the fire ground.
3. Real life motor and pump sounds need to be heard for the operator to be able to trouble-shoot the pump.

It is the opinion of the researcher that even the best computer-based simulator cannot meet these requirements. The FD-Training System when witnessed at FDIC-Indy was the hands-on practical training system that all potential pump operators should have the opportunity to utilize. The system allows the pump operator to use the equipment that will be used in the field operations hearing the pump and motor in operation thus allowing real-world operations of the vehicle. The unit allows the pump operator to actually flow water, read pump gauges, and use relief/governor controls. The unit similar to the driving simulator has a computer system that provides the instructor/trainee with a print-out of how the scenario was conducted and pump operator effectiveness.

The computer also has the ability to simulate problems with flows that will make the pump operator evaluate, trouble shoot and take corrective actions to repair the problem. The system offers a secondary use for fire departments trying to justify the purchase in that the unit can be used to service test fire apparatus. For students who have used the simulator it has received high marks in reality by experiencing the equipment they will use on the fire ground. One missing element the student discussed was the “emergency” aspect of pump operations. However, the students did compliment the adjust ability when the computer offers a problem scenario. From an environmental point of view, the system does not abuse water source and/or supplies in that the system re-circulates water used for the simulator. As with all simulators, the FD-Training simulator is not without issue. Like the driving simulator, the cost and maintenance of the equipment is a tremendous department commitment. The entry level simulator is \$40,000 with costs escalating depending on options requested by the purchaser. A second problem is storage because of the size of the unit. Due to the computer software, the system be stored inside of a structure. The last a concern with the unit and the company is the limited production. Currently, there are four units that have been purchased with two more on order. With the limited production durability and maintenance costs cannot be determined.

In the interviews with large fleet driving trainers, i.e., UPS and Fed-Ex, some training means were very acceptable to the fire service.

The large fleets use a program where a new driver is teamed with a designated trainer. Not every seasoned driver is considered a trainer and not all trainers train personnel on every type of vehicle. The initial part of the driving program is the orientation when the trainee will need to learn the agency's policies and state traffic laws for the specific vehicle and undergo a complete orientation of the vehicle. Once the orientation process has been completed, the trainee will be assigned to "mirror" the driver for an assigned time. Once a driver is assigned to the trainee, they are taught. speed management, parking, securing the vehicle, and vehicle control. When the driver feels it appropriate the trainee is allowed to drive the vehicle under the driver's direction. During this time the trainee is evaluated on the core skills.

Once the driver feels the minimum requirements are met, the trainee is sent to a master trainer to be evaluated for a week. When the master trainer evaluates the trainee they are either cleared to drive or sent back to the training driver for more instruction. Once a trainee is cleared, they are brought in quarterly during their probation period for evaluation and once off probation the driver is evaluated bi-annually by the mater trainers. Driving trainers are evaluated by master trainers bi-annually as well. The master trainers are evaluated by their peer groups annually and required to attend a minimum of two continuing education classes per-year.

For a driver to move up to the next sized vehicle; i.e., delivery truck to box truck or box truck to semi-tractor trailer, the driver must have a minimum of two years experience at the level below and then enter into the next level of training.

The accident training was an interesting component of the training sessions. Drivers who are involved in a vehicle accident, no matter the cause, are required to complete a training document. The document includes the circumstances surrounding the accident, diagrams of what happened, what the driver did to avoid the accident and what could have been done differently. The document is inserted into a report that is then submitted to all drivers for a training resource. If it is an occurrence that is happening frequently, training and master drivers are trained to include the topics in their in-service program in order to ensure consistency in training. If a driver is involved in three “at fault” accidents then the driver is sent back to their assigned training driver for remedial education, then the driver is sent back to the master trainer to determine effectiveness of the remedial training. There are slight variations between UPS and Fed-Ex but the essentials are outlined. Several of the large corporation fleet driving program components are applicable to FAO training.

Question 5. The interviews of Chief Feldmann and Chief Cummins were both difficult to conduct not only because of the subject matter, but because of the proximity of both fire departments to YCFPD. Chief Cummins brought a more passionate interview due to the fact he saw the entire accident.

Both Chief Officers agreed that this was a very trying time for their departments and relationships between the fire departments. Additionally, both Chiefs felt that the entire fire service should learn from this incident to prevent a reoccurrence of this of tragedy. Chief Cummins in witnessing the entire accident including seeing one of his staff ejected from the vehicle felt he could not believe what he was seeing. Both departments attended Critical Incident Stress Debriefing (CISD) in order to get through the initial loss. Both Chiefs stated that most of the personnel were more successful finding comfort in one another and family members. Chief Cummins did find one personnel who turned to alcohol and he assigned additional support that staff member.

Training for both departments consisted of road tests prior to a final driving test, pump operations training and in Stone Park what Chief Cummins described as an “occasional driver’s training session”. When Chief Cummins was asked to describe meaning of the term occasional, he made reference to a lack of objectives and training duration. He stated that most of the driver’s training is in moving personnel to the drill site or around town for errands. There were no set standards; i.e., VFIS obstacle course or Illinois Department of Transportation courses.

Since the tragedy Chief Cummins’s department has logged regular driver’s training schedules and sessions occurring at a minimum of once a month. All FAOs were required to attend a State Fire Marshal’s Fire Service Vehicle Operator (FSVO) Course and receive State certification as an FSVO.

Lastly, Chief Cummins instituted the requirement that all drivers were to complete the obstacle course included in the FSVO course at least a minimum of twice a year to remain active as an FAO.

Chief Cummins offered the feelings between the departments to this day remain stressed. While Chief Cummins has taken a chief officer position with another department; he felt to the day he left, the feelings were bad between the departments and added that he doubted if the departments would ever reconcile relationships. The hard feelings were at the firefighter levels, while the administrative staffs tried to work together. The Northlake Fire Department removed Chief Cummins's department from all automatic aid responses and moved the department down on all the box cards. Chief Cummins felt that this was a result of an ongoing lawsuit filed by three firefighters of the other department involved. Chief Cummins concluded the interview by offering that both departments had issues prior to the accident with one another and the accident just gave the personnel an issue to legitimately be angry with one another.

In the interview conducted with Chief Feldmann, most of the questions were answered with no specific or very short answers. It was felt by the researcher that interview questions were given consideration in the answers, however due to on-going litigation between the departments opinions and specifics surrounding the department's actions after the accident were contained.

In conducting these interviews it appeared that both departments held the other at fault. While blame can be laid in either organization, evidence provided shows that due to a lack of experience and/or solid driver's training programs a tragedy occurred.

DISCUSSION

The research for this project was benefited by the attention given to fire fighter fatalities, as well as civilian fatalities caused in fire apparatus accidents. The lack of training and inexperience for the FAO has been an issue since the early 1950's as evidenced by the article Training Fire Apparatus Drivers in Fire Engineering (1955). This article outlines specific competencies that the FAO should have prior to be trained as an FAO. Also, as part of this article a discussion of how to train the FAO, FAO evaluations and how often FAO skills should be evaluated are all topics. To reinforce the importance of this issue 25% of firefighter fatalities are while personnel are responding to or returning from incidents. In reviewing several NIOSH Firefighter Fatality Reports a strong opinion can be formed that a significant number of drivers involved in accidents have a range of between one to three years of fire service experience. This opinion is backed up by the researcher's survey which identified over 73% of the departments surveyed require personnel with one to five years of experience to perform FAO duties.

"Firefighters have "can do attitudes" ...it's a fact of life. The only problem is that sometimes we apply this attitude in "can't do" situations" Daly (2006, p.59). The first years of a firefighter's career are consumed with learning the essential functions of the job. To assume new firefighters can perform FAO duties with minimal time on the job is an opportunity for NIOSH to complete more firefighter fatality reports.

Daves (2006, p. 155) is noted to have said:

In today's fire service many apparatus operators are, in fact, amateur truck drivers operating large, heavy vehicles under emergency conditions. Given such circumstances, its obvious that these drivers will have a much greater accident potential or liability exposure than that experienced by regular commercial truck drivers.

Noting the lack of experience, the FAO training becomes even more essential to the success and safety of the driver, personnel on the vehicle and civilians surrounding the vehicle. Serious consideration must be given to personnel who want to operate fire apparatus and time on the job is only a one item that must be reviewed. Training officers and company officers should look at personal maturity, problem solving skills, and the ability to function in a controlled, effective manner during emergency operations.

During the literature research, it was found that some departments were administering a civilian driver's training program for dealing with the approach of an emergency vehicle. This class was conducted during fire prevention open house, at public education events, or any place where fire departments would come in contact with the public. For this project, not much time was spent researching this idea, but an outside look at how to train the public may be an objective to consider.

A second operational deficiency for current FAOs is in the area of pump operations.

While the research could not define any firefighter fatalities directly caused by pump operator error; numerous Firefighter “Close Calls” were documented. Most of the documented causes of pump operator errors were due to over-pressurizing hose lines. Similar to the actual inexperience of drivers, pump operations receive even less consideration. Several components of the researcher’s survey reinforce the opinion that pump operations are effectively being trained. Of the departments surveyed, 50% of the FAOs are trained on the job; 25% are trained through a OFSM or university program, 15% go through a formalized department program and a surprising 10% are self-taught. The question arises that 60% of the FAOs being trained have the possibility of being trained incorrectly. Also, the researcher’s surveyed how often the FAO’s core pump competencies were evaluated. The survey identified 50% evaluated the FAO’s skills annually, 10% bi-annually, 14% never, and 25% only after a problem was identified. The results showed that 14% of the department never evaluating the FAO skills and/or 25% only after a problem is identified correlates to the possibility 39% of the current FAO’s never having their skills evaluated. The recorded lack of training results, plus the statistical knowledge of a high probability that the FAO’s skills are never evaluated, can be the reason for the high number of “close-calls” and raises the potential for a firefighter fatality. As with the driver of the apparatus, a pump operator must be given the same review.

Candidates must show the ability to function under pressure, calculate hydraulic pressures and demonstrate personal maturity.

Through the survey results and interviews it appears only minimal efforts are being done to increase the level of FAO experience. With most departments using one to five year personnel with an average of three years experience, the need to increase experience levels is paramount. Starnes found the following:

“When an FAO comes to training its very important to match new skills with a training program that the FAO can use the training in the street. This will provide a greater chance of keeping them committed to the training and mastering their role” (p.102).

An area that needs follow-up research is the area of who is providing experience/training to the fire service FAOs. The researcher, while tabulating results from the survey conducted, found an interesting/concerning fact of who is providing the education to new/existing FAOs. While Training Officers and Company Officer are a tremendous resource for training, do these positions offer a proper education/experience base for FAOs? Results from the surveys revealed that Company Officers conducted the FAO training in 45% of the departments surveyed; in 42% of the departments that department Training Officers conducted the training; and in 6% of the departments current FAOs conducted the training.

While the officer positions may provide critical feedback on the FAO performance from an operational capacity; the time from when that officer was last behind the wheel of a vehicle or at the pump panel must be questioned. Lastly, identified as part of this survey was that 7% of the departments surveyed found that, FAOs were being “self-educated”. While this fact was found alarming by the researcher, it does coincide with the opinion of Daly (2006) who stated:

“Fire apparatus operators are being allowed to drive who do not know the limits of driving a large vehicle. I equate it to teaching an EMT class without going over basic anatomy. The student knows how to put a bandage on, but does not know why he or she is doing so” (p.59).

FAOs must have the essential experience needed to keep their emotions in check. When an FAO does not have the essential experience to keep their emotions in check, the vehicle can be driven in an unsafe manner to the incident or the pump operator may not be able to get water. Without experience level to draw from, even concerning basic aspect of fire fighting, the FAO can find themselves in trouble. Once the essential experience levels have been attained, the FAO should be trained by other FAOs who can provide essential experiences of functioning as an FAO. An FAO training an FAO will increase skills sets for operations and driving of fire apparatus. Company Officers and Training Officers can provide essential feedback on the FAO performance, but it is unrealistic for these positions to provide

accurate/essential foundation training for FAOs. Lastly, fire departments must have a formalized training program in place for their FAOs; “self-taught” is a dangerous practice.

In surveys conducted most fire departments are maintaining the skills of their FAOs in either a written test or practical skills assessment. The departments surveyed revealed that 33% were using a written test for evaluations, 48% were using both written and practical evaluations; and 18% were not evaluating their FAOs at all. It should be noted that the practical evaluation was in the driving aspects of the FAO role. Better than 85% of the department surveyed did not evaluate the FAOs skills on pump operations. When the survey respondents were questioned of why the skills were not evaluated, most felt it was a “difficult skill” to evaluate and that there were no “standards” to evaluate against. NFPA 1451 and 1002 requires “hand-on” pump operator training. Additionally ISO (Hickey, 1993, p.159) requires four half days of training or 16 hours operating pumps. The conclusion can be drawn that fire pump operation is again a forgotten essential function. Fire departments must evaluate their FAOs in all aspects of operations; i.e., practical skills of driving, written skills of driving and hydraulic calculations and practical pump skills in accordance with the NFPA, ISO and department standards.

ISO and NFPA consider simulators as acceptable means for training and evaluating FAOs. Several computer-based simulations were considered for use as a source to be researched. The researcher felt some of the simulators should not receive consideration due the researcher having actual experience with the simulator. The researcher has had experience with a computer-based pump operator simulator and several students and found the simulator very unrealistic and the end results can be achieved with a written examination. The researcher's students also had the same impression with the computer pump operator program. The computer-based simulation did not offer the essential components of engine noise, pump noise and the flow of water. For these reasons the computer-based pump simulators were not part of the research conducted.

Two driving simulators were identified with one that was currently being used by the fire service. No data was available from mid to small sized fire departments, so data was used from two end-user large departments. LAFD and FDNYEMS use the FAAC, Inc., simulator. The unit has met with a tremendous amount of success for both departments, even though it is used in different ways. The driving units do come with concerns, most evident is cost. The cost is significant for a single simulator and the essential components to make the unit function are an estimated \$ 40,000 per simulator. Training with the driving simulators can also be problematic.

Both FDNYEMS and LAFD found that students who attended the training too often did not come away with the essential component of the training. The training became more of a video game to master without consequences of being properly trained. Overall it was felt that simulators can provide essential training, and scenarios can be put into the simulator to increase the FAO skills sets, but the costs of the simulator can be too much to overcome.

One pump operator simulator was found available that provided “hands on” training. The unit from FD-Training Systems is a computer-scenario based simulator that connects to the FAO’s apparatus to pump water. This simulator has several positive features; first and foremost it allows the FAO to use the fire apparatus they will use in their work environment. The simulator allows the FAO to trouble-shoot problems with the pump and the vehicle because both are in operation during the simulation. The simulator can conduct multiple line scenarios and problem scenarios that the FAO must figure out. Lastly, because the simulator is computer-based, a print out can be evaluated and critiqued on the FAO’s performance. There are shortcomings with the simulator; as with the driving simulator the cost for the unit is substantial depending on options and storage of the unit is an issue. The simulator is a new development in training, making data on its effectiveness and reliability unavailable. Lastly, a student had one concern that was the lack of the sense of emergency that the fire ground develops. Overall, both simulators definitely have shown success in the fire service.

While the pump simulator is a new product, all evaluations, students and fire service professionals have found the training to be effective. The main concern is cost and how the single small to mid-sized department can afford the simulators. Even with available grant funding, noting FDNYEMS and LAFD's experiences, will the effectiveness of the training be lost due to the frequent use of the training simulators?

The long-term effects of a fire apparatus accident are felt in several different areas: 1. Financially to the department in injury to personnel, 2. Lost revenues to repair the apparatus, 3. Feelings of mistrust between personnel, and 4. Increased insurance costs.

However, when a firefighter's life is lost these feelings become magnified by casting feelings of blame and doubt on the department. The financial losses may or may not be recoverable, but the doubts and blame may never be repaired. In order to avoid this type of incident, departments must develop solid, enforceable policies regarding fire apparatus operations. These policies should be reviewed at a prescribed time to ensure accuracy. Departments must institute a driver training program that meets attainable objectives and each session must be documented. The department FAOs must have their skills evaluated both in driving and pump operations a minimum of twice a year. The only way to reduce firefighter fatalities is through pro-active measures to ensure the FAO skills remain at the peak levels of performance.

RECOMMENDATIONS

Research Questions 1. The YCFPD should review the current FAO policy and evaluate the current minimum qualifications to become an FAO. The YCFPD should also develop a Safe Driving Committee to evaluate the program, monitor driver training programs, review accidents and develop a training session from all accidents reviewing any recommendation brought forth by YCFPD Company Officers and administration. One recommendation offered by the researcher is to minimize officer participation in this committee. It is recommended that one chief officer and the Training Officer are the only officers allowed to participate. The Chief Officer's participation for administration of the program and the Training Officer's participation for evaluation purposes. An additional recommendation would to request be the Public Education Division develop a civilian training program of how to respond when an emergency vehicle approaches.

Research Question 2. The YCFPD should conduct quarterly fire pump operator refresher training. This will have the FAO out pumping water and doing hydraulic calculations. Additionally, on a monthly basis the Training Division should produce hydraulic word problems for the FAOs to complete and submit to the Safe Driving Committee. Lastly, all current FAOs will be required to attend one yearly pump certification with the District mechanic in order to understand pump mechanics and to learn to trouble shoot mechanical issues should the pump should fail.

Research Question 3. The YCFPD will divide current FAO training in two sections: current FAO and new FAO. New FAOs will be sent to an Office of the State Fire Marshal Fire Service Vehicle Operator Class. Once completed and certification is granted, the FAO will be assigned a mentor for one month to learn the orientation portion of all the apparatus. The mentor can be any YCFPD member who is currently an approved FAO by the Safe Driving Committee. Once the new FAO has met the approval of the mentor, the FAO will be assigned to a member of the Safe Driving Committee for final certification. Once all driving requirements have been met, the FAO will be sent to an outside course to attain Office of the State Fire Marshal certification as an engineer. Once the FAO returns with certification, they will be assigned to the Safe Driving Committee to have their fire pump skills evaluated. Once given clearance, the new FAO will be under a probationary period of one year where they will be required to meet the same criteria as an experienced FAO.

Research Question 4. The YCFPD will continue to evaluate the current FAOs. However, the extent to which the evaluations are conducted will be increased. Current FAOs will be required to document 20 hours of driver's training a year, increasing from the current 10 hours currently in place. Current FAOs will be required to complete the VFIS obstacle course twice a year, increasing from the current once a year. One of these courses will be performed at night. Both of the increased requirements will be allotted for in the monthly and yearly training calendars.

The current FAOs will be required to participate in quarterly pump operations drill and one must be attendance at a yearly pump test with the YCFPD mechanic. Also the YCFPD will require a documented Department of Transportation physical from every FAO at the YCFPD's expense. Lastly, the YCFPD will require the Training Division to establish an Accident Training Program. The Program will include forms for the driver involved in the accident to complete answering the following: what were the circumstances of the accident, what were the road/weather conditions, what the driver did, and what the driver should have done. This will then be developed into a training program and presented to all personnel. All accident training will be kept on file and reviewed as part of a company drill once a year.

Research Question 5. The current YCFPD Training Officer will be encouraged to take the simulator research and present it to the Mutual Aid Box Alarm System (MABAS) which incorporates 20 towns that surround the YCFPD. The presentation will give an overview of the simulators and review the positives and negatives of simulator-based training. With personnel from surrounding departments participating in simulator-based training a larger group can be educated and the possibility of cost divisions can be utilized. Additionally, similar to what LAFD did to disperse costs, the simulators can be rented out and funding brought in through the MABAS Division. While the benefits of simulator-based training are easily seen, how to pay for the units is a hurdle that must be addressed on a larger scale.

Research Question 6. The researcher reviewed several fire apparatus accidents where firefighter fatalities occurred. Beyond the noted lack of driver experience and questionable mechanisms for training current FAOs, an area of concern is FAO policies and procedures. The most successful training experience developing programs can be instituted, but without sound, enforceable policies firefighter fatalities will still occur. In the accidents where firefighter fatalities occurred, the majority resulted from firefighter being ejected from the vehicle; i.e., not wearing seat belts. The best training program does not enforce personnel wearing their seat belts. The YCFPD should adopt a policy to have the Driving Safety Committee evaluate the driver's training policy every two years unless a substantial change is required earlier. Additionally the Driving Safety Committee should evaluate FAO training hours on a yearly basis to ensure the minimum training hours are met. Overall, the researcher felt two areas must be addressed to reduce firefighter fatalities: 1. More effective FAO training and experience and 2. Effective, enforceable policies and procedures for the FAO. Daly (2006) stated:

“Accidents will happen and, in today's atmosphere of knee jerk litigation, every fire company or department would be well advised to take steps now to increase the safety of their emergency driving operations and to improve their stance in any future liability action” (p.60).

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APPENDIX A:**Summary of Interviews & Questions used for interviews of Chief****Cummins and Feldmann**

- 1. What were your initial impressions when you heard your apparatus was involved in an accident and further what were your reactions when you found out it was with another fire apparatus?**

Cummins Answer: When the accident occurred, I was following the engine and witnessed the entire event. My initial impressions were that they must see each other, they must be going to miss one another, this is not happening. I have described to many people that it felt as if my depth perception had gone away. I truly could not believe what I was seeing.

Feldmann Answer: When I heard what had happened I thought the entire thing was a mistake or that I was hearing things. Driving to the scene I kept thinking maybe it was another department's vehicle. When I arrived on the scene I saw our personnel's bunker gear working and attempting to extricate the firefighters from the other town. At that point I knew it was real and that this event would effect the entire fire service.

- 2. What coping mechanisms did your personnel use to cope with the incident?**

Cummins Answer: We all gathered at the hospital, and did a bedside prayer and said our goodbyes with FM Bergstrom. After we returned to the station where we sat through the CISD. Most of the members of the department found comfort in loved ones and each other. We kept ourselves busy planning the funeral and getting equipment to return into service. I do know that one firefighter did turn to alcohol and needed some help down the road. We had a lot of stories to tell and laugh about with FM Bergstrom's life and that helped a lot.

Feldmann Answer: There were and still are hard feelings. When companies returned there was a lot of communications between personnel, on what had happened, but the hardest thing for us as administrators was dispelling the rumors of what had happened and what was going to happen.

3. What were your training requirements prior to the accident for the training of FAOs?

Cummins Answer: Training prior to the accident included, the standard SOS drivers exam for Non-CDL B with several road tests prior to the final exam, pump operations training, and an occasional drivers training session which often tied into some other form of training.

Feldmann Answer: Northlake has always had a very stringent driver's training program, using State outlines and objectives. We also require drivers to meet the requirements of the State of Illinois Department of Transportation regulations i.e.; appropriate license and training prior to driving any vehicle.

4. How has your department increased FAO training since the accident?

Cummins Answer: That department began to log regular drivers training sessions, occurring at least once per month, all drivers were required to attend the OSFM FSVO course and on a six month rotation were expected to complete the practical portion of the course to continue to be an eligible driver.

Feldmann Answer: This answers Feldmann reinforced what was stated in Question 3.

5. What is the feeling in your department since the accident with the members and toward the other department?

Cummins Answer: Feeling between the departments remained bad up to the last day I worked in Stone Park and I would doubt that they are any better. The Chiefs and Deputy Chief were not the issue; it came down to firefighter vs. firefighter. Stone Park was removed from running automatic aid into the other town as well as moved down on the box cards for other events. I think one thing that caused a lot of hard feelings resulted from the ongoing lawsuit filed by the three firefighters on the other unit against Stone Park; many of the Stone Park firefighters did not understand what the other department had lost that made an action like this take place. The two departments had issues between them long before the accident; this just gave them both something legitimate to be mad at each other for.

Feldmann Answer: Chief Feldmann declined answering this question, citing legal issues and not wanting to damage attempts to improve relations between the departments.

APPENDIX B:

Summary of questions used for interviews of simulator manufacturers and end users of the equipment.

- 1. What is the name of the company, location of the company, how many units have been sold and to whom?**
- 2. Identify the components of the training program and what equipment is necessary to make the equipment as effected as possible.**
- 3. How are the instructors of the purchaser trained?**
- 4. What are the positive and negative characteristics of the training simulators?**
- 5. What would the cost of a simulator that would be effective for York Center Fire Protection District?**
- 6. What feedback back has been received back regarding service, break-downs, and over-all use of the simulators?**

APPENDIX C:

**Summary of questions used for interviews of large fleet driving trainers
from UPS and Fed-Ex.**

- 1. How does your organization train drivers?**
- 2. How much time must personnel have on the job to operate as driver?**
- 3. Does your organization have a formalized driver training program?**
- 4. How do drivers for your organization receive initial training?**
- 5. Who currently trains your drivers?**
- 6. How often are your driver's core competencies evaluated?**
- 7. How are your organizations driving core competencies evaluated?**